

**Semi-Integral Control Module
For WE/SE/XE Electric Actuator**

Installation & Maintenance Manual



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Introduction:

The Semi-Integral control module provides local control to the WE or WEM series electric actuators with two non-intrusive selector switches. The WE series is for two position control and the WEM is for proportional control. The WEM can be configured to fail either in place, clockwise or counterclockwise on loss of control signal.

**Warning**

- Provide power that complies with the actuator specifications.
- Do not expose the actuator to rain when wiring it outside.
- Turn off power before wiring.
- Ensure proper grounding and electrical connections according to wiring diagram to prevent electric shock or damage to the actuator.
- Do not make any modifications to any boards. Doing so may result in malfunction or damage.
- Regularly inspect the actuator for signs of wear or damage and replace any worn components immediately.
- Do not exceed the specified load capacity of the actuator to avoid equipment damage or personal injury.
- Do not attempt to repair or disassemble the actuator yourself. Contact qualified personnel for assistance.
- Follow manufacturer's instructions for installation, operation, and maintenance to ensure safe use of the actuator.
- DO NOT provide power to the open/close/stop inputs. This will cause damage to the actuator board.

Storage

1. Keep conduit entries sealed. For short-term storage (less than 1 year), temporary shipping plugs can be used. If storing for longer periods, the shipping plug should be replaced with an appropriate sealing plug.
2. To prevent condensation inside the actuator, avoid large temperature changes to the ambient temperature and store in a well-ventilated, clean, dry room. Ideal storage temperature is between 40°F (4°C) and 85°F (29°C), with relative humidity below 70%.
3. Store the actuator where it is not exposed to vibration or direct sunlight.
4. Store the actuator on a shelf or pallet, where it is protected from direct contact with moisture.
5. Keep the actuator covered to protect it from dust and dirt.
6. Storing the actuator in a sealed plastic bag is recommended for long-term storage.
7. Long-term outdoor storage is not recommended. If storing outdoors, store the actuator off the ground and prevent immersion in water or snow.

General Information and Features:

Semi-Integral control module controls electric actuator by remote command signal, or by local open/close selector switch.
 Built in phase discriminator can protect actuator when moving in the reverse direction.
 INCHING or HOLD mode reacts on pulse or continuous signal.
 Has configurable fail position (in place, close, open).

General Specifications

Item	Conditions
Supply Power	3 ph – AC 220V, 380V, 400V, 440V, 460V, 480V 50Hz/60Hz 1 ph – AC 110V/220V
Internal Control Voltage	DC 24V, DC 5V
Power Consumption	5 VA
Temperature/Humidity	-20°C to 80°C / 90% RH, max.
Temperature Factor	±0.015% / °C
Control	Inching/Hold mode by dip switch for on/off Analog signal for modulating
Dielectric Strength	1500V AC, 1 minute
Insulation resistance	500V DC, 50MΩ or more
Vibration and shock	Z axis 1g/3g, frequency: 100-200Hz, time: within 30 minutes

Modulating Control Specifications

Item	Conditions
Input Signal (setpoint)	4-20mA DC, 1-5V DC, 2-10V DC 0-20mA DC, 0-5V DC, 0-10V DC
Input Signal resistance	250Ω, position resistance: 100-10kΩ
Output Signal (feedback)	4-20mA DC, 1-5V DC, 2-10V DC 0-20mA DC, 0-5V DC, 0-10V DC
Load Resistance	500Ω max
Dead time	0.2 - 7.5 sec - Step 0 : 0.2 sec - Step 1 – 4 : 0.25 – 1 sec (0.25sec / step) - Step 5 – 15 : 2.5 – 7.5 sec (0.5sec / step)
Dead Band	0.4 – 7.5% - Step 0 – 4 : 0.4 – 0.8% (0.1% / step) - Step 5 – 9 : 1 – 1.8% (0.2% / step) - Step 10 – 15 : 5 – 7.5% (0.5% / step)
Fault mode	Fail close, Fail open, Fail in place
Position conversion accuracy	±0.2 to 5% (may vary depending on conditions)

Local Control:

Local control consists of two non-intrusive magnetic selector switches and 5 LED indicators.

Mode Selector Switch:

The selector switch on the right side of the module decides the operating mode; Remote, Stop or Local.

Remote: The actuator would work according to the incoming control signal (discrete or analog) from remote source.

Stop: All command signals, regardless of local or remote, are ignored and only the display status is updated.

Local: The actuator works according to the signal generated by the local command of either close or open using the Action selector switch.



Action Selector Switch:

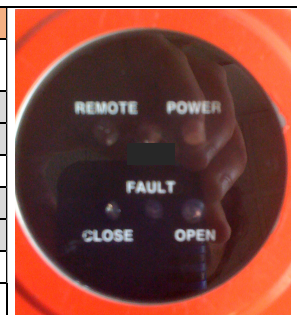
The selector switch on the left side of the module permits local operation of the actuator open or closed. The switch is momentary and will automatically return to neutral position after generating either open or close command. The switch will only provide operation if the Mode selector switch is in the Local position. Two types of operation are possible based on the settings of the internal DIP switches.

Inching Type: Actuator works only when command signal is present.

Holding Type: Actuator continues to run until getting a stop command or trips the end of travel switch.

Display:

LED Name	Color	Description
POWER	White	External power is present
REMOTE	Blue	Mode switch in "Remote", Digital input
	Flashing	Mode switch in "Remote", Analog input or Auto scan function
FAULT	Amber	Fault condition (see below)
CLOSE	Green	Actuator is in the full closed position
	Flashing	Actuator is traveling towards the closed position
OPEN	Red	Actuator is in the full open position
	Flashing	Actuator is traveling towards the open position



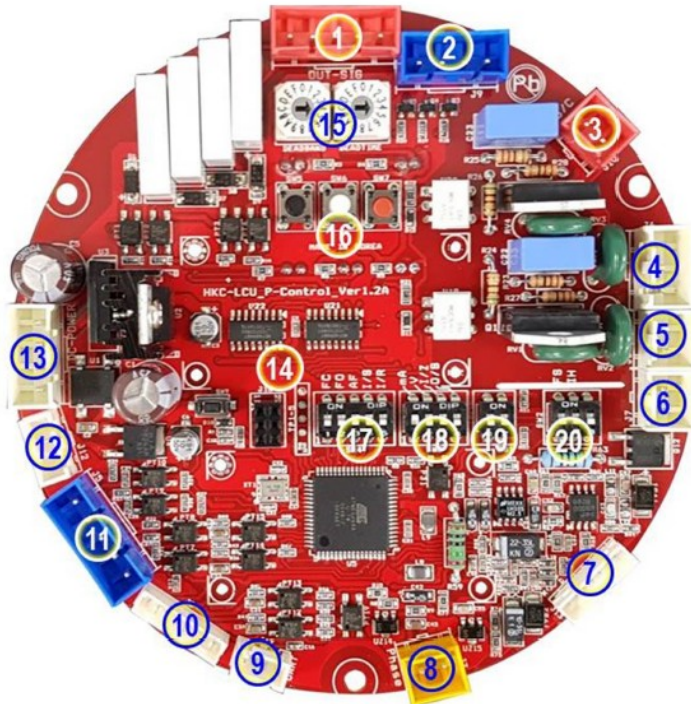
General FLED Function:

Condition	CLOSE (Green)	FAULT (Amber)	OPEN (Red)
Full Close	ON	OFF	OFF
Full Open	OFF	OFF	ON
Moving Close	Flash	OFF	OFF
Moving Open	OFF	OFF	Flash
Fault – Close Torque Switch*	ON	Flash	OFF
Fault – Open Torque Switch*	OFF	Flash	ON
Fault –Reverse Connection	ON	Flash	ON

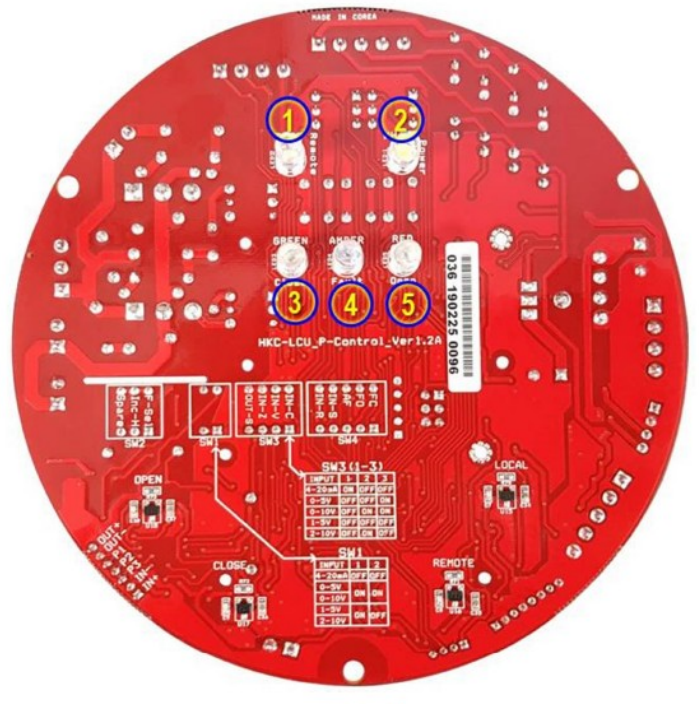
* Reverse direction from fault to clear

PCB Layout:

PCB with PCU function shown



Front



Back

Front

Connectors				Switches	
No.	Part	No.	Part	No.	Part
1	Relay output signal	8	Phase check connector	15	Deadband & deadtime*
2	3-phase motor connector	9	Communication port	16	Close (black), Open (white) & ASCAN (red) button*
3	Capacitor connector (1ph)	10	Limit & torque switch signal connector	17	5-pin DIP switch (SW4)*
4	1-phase motor connector	11	Remote signal	18	4-pin DIP switch (SW3)*
5	220V ac input	12	5V dc & 12V dc output	19	2-pin DIP switch (SW1)*
6	220V ac output	13	28V ac & 10V ac input	20	3-pin DIP switch (SW2) 1P: Fault relay NO/NC 2P: Inching/Holding 3P: N/A
7	Set point, potentiometer & feedback	14	Program upload connector		

* Only applicable to modulating units

Back

No.	Position	Color	Signal
1	LED 1	Blue	Remote
2	LED 2	White	Power
3	LED 3	Green	Close
4	LED 4	Amber	Fault
5	LED 5	Red	Open

DIP Switch #1, Fault Output

#2	
ON	The contact for the fault is normally closed. The contact will open when a fault occurs.
OFF	The contact for the fault is normally open. The contact will close when a fault occurs.

DIP Switch #2, Holding / Inching

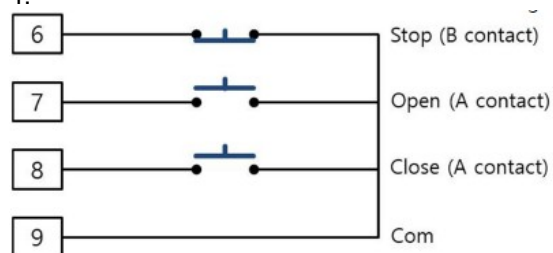
#1	
ON	HOLDING – When given a signal to change position, the actuator continues to run until a “Stop” command is provided or reaches the end of travel limit switch.
OFF	INCHING – When given a signal to change position, the actuator continues to run only while the signal is provided. If the signal is removed, the actuator will stop movement.

NOTE: Face cover of the control module must be removed to access the push buttons and DIP switches.

On/Off Control:

Dry contacts control (command contact)

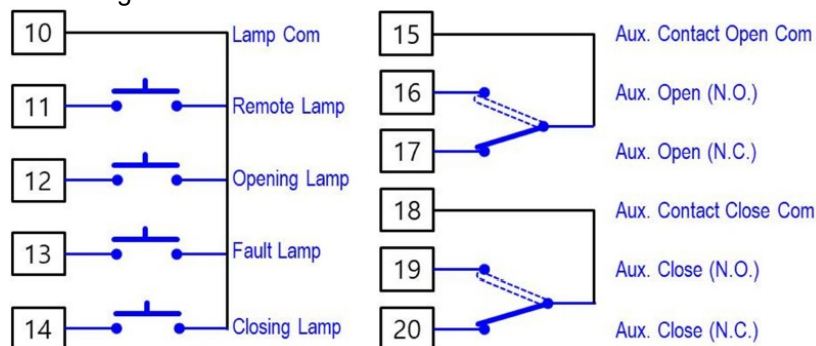
1. Command function is activated when input an action with external dry contact.
2. Holding / Inching can be selected with DIP switch (SW2)
3. Connect to actuator terminals referring to figure below.
- 4.



5. Actuator will not work if 6 (Stop) and 9 (Com) terminals are not connected.
6. Check action of actuator after wiring.
7. With 6 (Stop) and 9 (Com) connected:
Connect 7 (Open) to 9 (Com) to move actuator open.
Connect 8 (Close) to 9 (Com) to move actuator close.

External output signal contacts

1. External output signal contacts provide actuator status to digital inputs or signal lamps.
2. Wiring should be as shown below.



Output/Lamp	Function
Remote	10 to 11 connection when selector switch in Remote position
Opening	10 to 12 connection when actuator is moving open
Fault	10 to 13 connection when fault detected (torque switch or phase connection error)
Closing	10 to 14 connection when actuator is moving closed
Aux Open contact	15 to 16 connection when in full open position, 15 to 17 when NOT open
Aux Close contact	18 to 19 connection when in full close position, 18 to 20 when NOT close

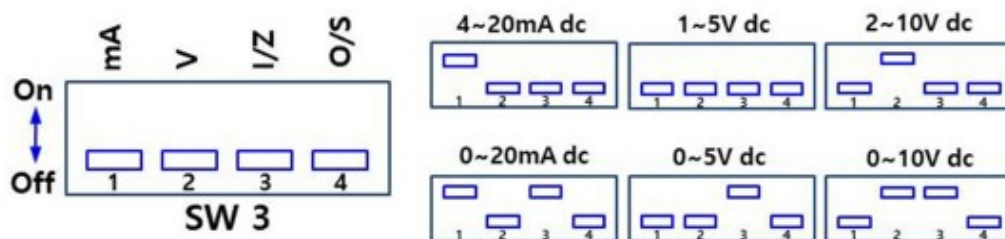
Proportional Control:

The internal servo card can accept and output a variety analog control signals. The servo card can also be configured for a specific fail position on loss of input signal. The servo card always uses the motor control end of travel limit switches as the starting and ending points of travel.

NOTE: Face cover of the control module must be removed to access the push buttons and DIP switches.

Input Signal:

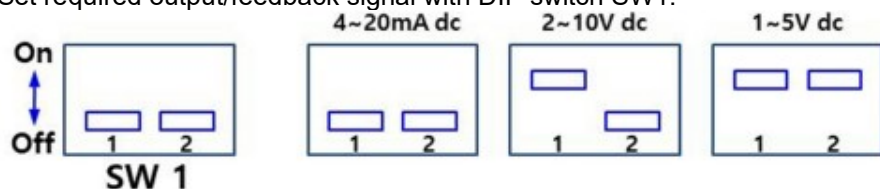
Select required command signal type with DIP switch SW3.



DIP switch SW3 is set to 4-20mA as default.
Zero switch SW3-3 is applied to input and output signals equally.

Output/Feedback Signal:

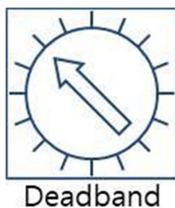
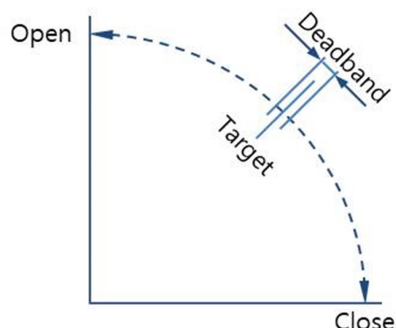
Set required output/feedback signal with DIP switch SW1.



DIP switch SW1 is set to 4-20mA as default
Zero switch SW3-3 changes minimum value to 0mA or 0V

Deadband:

Deadband sets the maximum allowable tolerance of the actuator stop position from the command signal. It is also the minimum difference value for starting a new movement.



Deadband Module



Adjustable setting range: 0.4 – 7.5% (16 steps available)

- Step 0 – 4 : 0.4 – 0.8% (0.1% / step)
- Step 5 – 9 : 1 – 1.8% (0.2% / step)
- Step 10 – 15 : 5 – 7.5% (0.5% / step)

Default setting is 4.

If setting is too low, the actuator may have difficulty finding the target point and hunting may occur, which can result in failure of actuator. Increase deadband setting to reduce hunting.

Deadtime:

Deadtime is the minimum time to maintain the input signal to satisfy the deadband. This is to reduce abnormal operation of the actuator from external disturbance such as noise on the input signal.



Deadtime Module

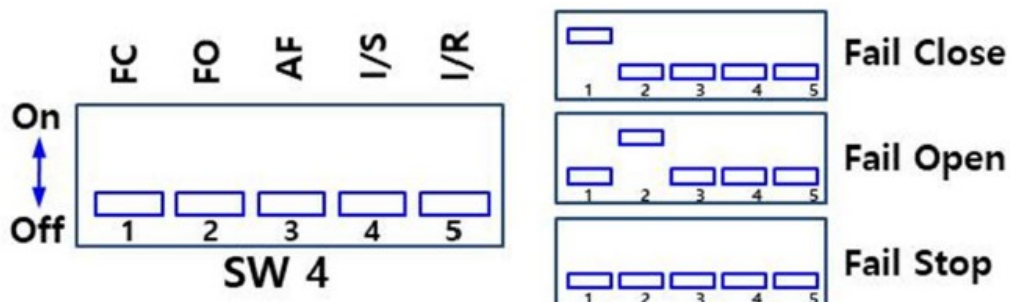
Adjustable setting range: 0.2 - 7.5 sec (16 steps available)

- Step 0 : 0.2 sec
- Step 1 – 4 : 0.25 – 1 sec (0.25sec / step)
- Step 5 – 15 : 2.5 – 7.5 sec (0.5sec / step)

Default setting is 4.

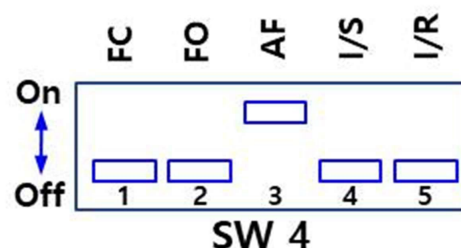
Fail Position:

When analog command signal is lost or incorrect, a fault is detected and the actuator will fail in place, fail to the open position, or fail to the close position based on setting with DIP switch SW4.



Auto Full Action (AF):

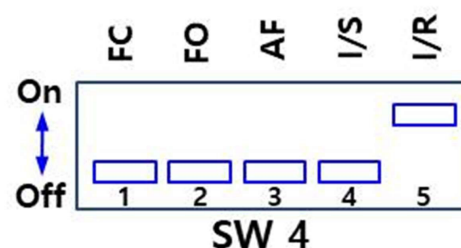
With DIP switch SW4-3 on, the actuator will move to the fully close position at input signal of 4.3mA or lower, and move to the fully open position at 19.7mA or higher.



Reverse Action (I/R):

With DIP switch SW4-5 on, the actuator will respond to input signal in reverse, so now 4mA moved actuator fully open, and 20mA moves actuator fully closed.

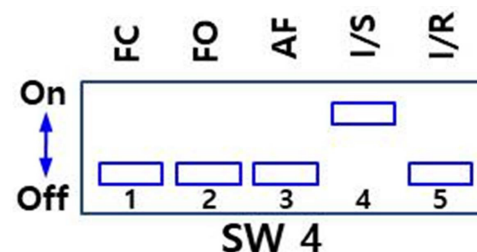
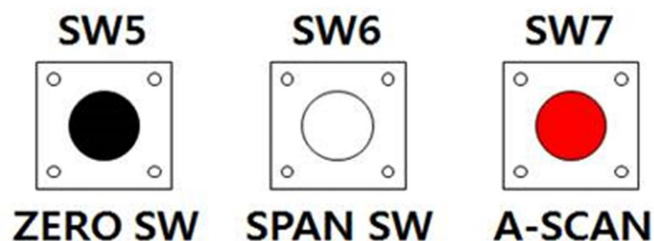
SW4-5	Command and Feedback
OFF	4mA = Close 20mA = Open
ON	20mA = Close 4mA = Open



Input Signal Adjust (I/S):

With DIP switch SW4-4 on, the command zero (fully close) and span (fully open) signal can be adjusted.

Mode selector switch must be set to "Stop" for this function.



Example: Set signal range as 5 – 19mA

1. Confirm Mode selector switch is in "Stop" position.
2. Turn on DIP switch SW4-4.
3. Red and green LED will flash for approximately 1.5 seconds.
4. Green LED will flash to indicate zero setting.
 - a. Input zero command signal (5mA) and then push Zero button (black).
 - b. If successfully set, yellow LED flashes once, and green LED turns on solid.
5. Red LED will flash to indicate span setting.
 - a. Input span command signal (19mA) and then push Span button (white).
 - b. If successfully set, yellow LED flashes once, and red LED turns on solid.
6. After 1.5 seconds, the sequence can be repeated from step 3.
7. To quit this setting, turn off DIP switch SW4-4.

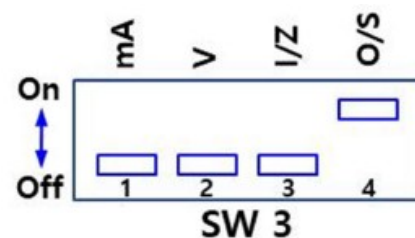
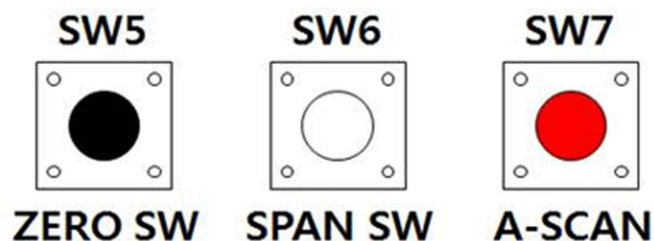
Signal	Range
Zero	3 – 8mA
Span	16 – 21mA

If DIP switch SW4-4 is turned off during the process, or if there is no action performed for 2 minutes, the setting is cancelled.

Output Signal Adjust (O/S):

With DIP switch SW3-4 on, the output signal can be adjusted.

Mode selector switch must be set to "Stop" for this function.



Each time the Zero button (black) is pressed, the output signal decreases.
Each time the Span button (white) is pressed, the output signal increases.

Example: Adjust output signal to 4mA for zero, and 20mA for span.

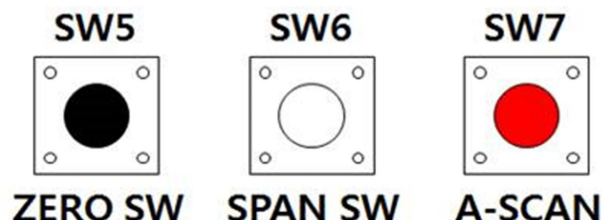
1. Confirm Mode selector switch is in "Stop" position.
2. Turn on DIP switch SW3-4.
3. Red and green LED will flash for approximately 1.5 seconds.
4. Green LED will flash to indicate zero setting.
 - a. Adjust output signal to a value of 4mA by pressing the Zero or Span button.
 - b. Confirm the 4mA output by pressing the A-SCAN (red) button.
 - c. If successfully set, yellow LED flashes once, and green LED turns on solid.
5. Red LED will flash to indicate span setting.
 - a. Adjust output signal to a value of 20mA by pressing the Zero or Span button.
 - b. Confirm the 20mA output by pressing the A-SCAN (red) button.
 - c. If successfully set, yellow LED flashes once, and red LED turn on solid.
6. To quit this setting, turn off DIP switch SW3-4.

If DIP switch SW3-4 is turned off during the process, or if there is no action performed for 2 minutes, the setting is cancelled.

Auto Calibration:

Auto calibration automatically sets the open and close positions based on the actuator limit switches. Zero input signal corresponds to the set close position, and span input signal corresponds to the set open position.

Mode selector switch must be set to "Stop" for this function.



Check connection status of input power, and input/output signal, after actuator and valve are correctly assembled.

Start the auto calibration process with either of the following methods.

A. Press the A-SCAN (red) button on the control PCB.

This will require opening the face cover to the module.

B. Operate front display selector switches.

1. Confirm "Stop" position of the Mode selector switch.
2. Hold switch "Close" for 5 seconds.
3. Blue LED will change from on to off.
4. Operate switch "Open" within 3 seconds, and hold for 5 seconds.
5. Blue LED will change from on to off.
6. Change Mode selector switch to "Local", and then back to "Stop"

The auto calibration sequence is as follows.

1. Blue LED flashes during sequence.
2. The actuator will move to the fully closed position.
 - While moving to the closed position, the green LED will flash.
 - When closed position is reached, green LED turns on solid.
 - If actuator is already at closed position, the closing operation will be skipped.
3. The actuator will move to the fully open position.
 - While moving to the open position, the red LED will flash.
 - When open position is reached, red LED turns on solid.
4. The actuator returns to the fully closed position.
 - While moving to the closed position, the green LED will flash.
 - When closed position is reached, green LED turns on solid.
5. When sequence is completed successfully, blue LED turns on solid.

NOTE: During the auto calibration process, if any button or switch is operated, the auto setting process will be terminated.

Proportional Control LED Errors:

No.	Error type (Malfunction)	(White)	(Green)	(Amber)	(Red)
1	Mode selector switch	OFF	OFF	OFF	ON
2	Mode selector switch (Local)	OFF	OFF	ON	OFF
3	Mode selector switch (Remote)	OFF	OFF	ON	ON
4	Limit switch	OFF	ON	OFF	OFF
5	Torque trip	OFF	ON	OFF	ON
6	Incorrect phase connection	OFF	ON	ON	OFF
7	CPU error	OFF	ON	ON	ON
8	Command signal error	ON	OFF	OFF	OFF
9	Auto calibration error	ON	OFF	OFF	ON
10	Loss of command	ON	OFF	ON	OFF
11	Motor reverse	ON	OFF	ON	ON
12	Command signal selection mismatch	ON	ON	OFF	OFF
13	Potentiometer error	ON	ON	OFF	ON
14	Opening error	ON	ON	ON	OFF
15	Closing error	ON	ON	ON	ON

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For product specifications go to <http://download.a-tcontrols.com/>

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